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Progress Report USNRDL-P-24

RADIOLOGICAL SAFETY AT USNRDL

ANNUAL PROGRESS REPORT 1959

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RADIOLOGICAL SAFETY AT USNRDL - 1959

Progress Report USNRDL-P-24

[redacted]

Annual Progress Report
For Period 1 January to 31 December 1959

Health Physics Division

Captain [redacted], (MC) USN
Radiological Medical Director

Captain (b) (6) [redacted], USN
Commanding Officer and Director

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
San Francisco 24, California

INTRODUCTION

The operation of the Health Physics Division during the year can be divided into three main programs.

Under Program 1 - Health Physics personnel supported the general Laboratory Operations which included Laboratory consultation and monitoring for the various divisions, dosimetry, radiological services (including waste disposal), environmental surveys, and radiological safety instrumentation .

Under Program 2 - Radiological safety evaluations were made for various segments of the Laboratory, as well as outside agencies. Training in radiological safety regulations and procedures was also supplied under this program.

Under Program 3 - Health Physics personnel participated in support of two field operations, Camp Parks and Naval Ordnance Testing Station (NOTS) PROJECT 173.

SUMMARY

The operation of the Health Physics Division during the year can be divided into three main programs: Health Physics Measures for Laboratory Operations, Radiological Safety Evaluations, and Special Operations.

Program 1 - Health Physics Measures for Laboratory Operations

Health Physics Division continued its regular monitoring services for various scientific divisions of the Laboratory. Only 133 routine monitoring surveys and ca. 60 special monitoring surveys were performed in various Laboratory work spaces. The reduction in the number of surveys was the direct result of a manpower shortage during which time this particular program was temporarily halted. There were two minor radiological accidents in 1959, one of which revealed a beta exposure of 3.5 rad. Five minor contamination incidents occurred during the year, three of which involved contamination of the clothing of personnel of the Laboratory. In each case of contamination, the clothing and equipment were successfully decontaminated.

The dosimetry service for the Laboratory, NRDL visitors and various outside agencies was continued. Twenty-one exposures in excess of the monthly maximum personnel exposure (1.2 r) were detected during the year by the film badge program. Twenty of these exposures, varying from 1.5 to 4.0 r, were associated with the Camp Parks experimental program. The remaining exposure involved an investigator who received 1.42 rem of gamma and neutron radiation while working at the University of California 60-in. cyclotron. Accountability services for radioactive material and for cyclotron- and reactor-irradiated samples were carried out.

The radioactive waste disposal operation continued discharging at sea during 1959. Analysis of the results of the environmental monitoring program indicated that there was no significant release of radioactive aerosols by NRDL operations during 1959. The air and water effluent monitoring system was completed and placed in working order during the year. The over-all operation of the system indicated that it is superior to previous equipment of this type used by the Laboratory.

The radiological safety instrumentation program continued; a remote area monitoring system was installed and a prototype water line monitor was built to monitor continuously one of the main sewer lines from Bldg. 815.

Program 2 - Radiological Safety Evaluations

The Laboratory received many requests from ships and outside activities for assistance in the evaluation of special radiological problems. Included were the monitoring of facilities and offices for contamination, the calibration of instruments, and decontamination of a barge. Rad-Safe Inst. were written or

reviewed, training films were reviewed, and information to be incorporated in a BuWeps ordnance pamphlet was submitted. Training courses in radiological safety were written for and presented to outside activities as well as NRDL groups.

Program 3 - Special Operations

The Health Physics Division continued its support of field operations. The Stoneman II rad-safe report was issued. The RADCON program was given rad-safe support in checking out counting equipment, and in the preparation of standards for field use with monitoring instruments. Radiological safety support was provided for three NOTS Project 173 weapons vulnerability tests. An evaluation of the contamination potential of the operational suitability test program conducted at NOTS was made. A radiological monitoring survey of air, soil, sanitary sewer effluent, and vegetation in the Camp Parks area was made before and after the arrival of radioactive materials. A document entitled "Rad-Safe Criteria for NRDL Operations at Camp Parks" was issued.

Program 1.0 Health Physics Measures for Laboratory Operations

This program is chiefly concerned with direct health physics support of Laboratory operations. An average of 82% of the available effort was expended on Program 1.0 assignments. This program is divided into five subgroups to facilitate program planning and reporting.

Project 1.10 Laboratory Consultation and Monitoring

General

The routine monitoring program was continued during 1959. However, during the third quarter of the calendar year, the program was temporarily halted because of a manpower shortage. Nevertheless, 133 weekly and monthly surveys of all spaces where radioisotopes are normally used were completed during the year. No evidence of significant amounts of uncontrolled radioactivity was disclosed. Only two minor discrepancies were observed; one involved contamination in some of the Laboratory sinks; the other was low-level floor contamination in the laundry, a result of the handling of contaminated clothing.

The annual Laboratory-wide monitoring survey was completed. No detectable contamination was discovered in uncontrolled locations.

Chemical Technology Division

Major effort was put forth in preparing for the HYDRA I test to be made at the David Taylor Model Basin (DTMB). A radiological safety plan, documenting the rad-safe coverage to be provided for the operation, was prepared. The rad-safe materials and equipment needed in support of the operation were assembled and shipped to the DTMB. Project personnel were indoctrinated in rad-safe techniques to be used during the operation.

The rough draft of the rad-safe report for HYDRA I was completed and reviewed. The final draft, ready for submission to the NRDL Reports Review Board, is scheduled for completion early in 1960.

A series of building wash-down studies were completed during the first quarter. Stoneman-type soil with 0.1 curies of La^{140} (Materials Testing Reactor (MTR) irradiations) was used as a tracer. Fission products in the millicurie range (MTR irradiation) were used in the decontamination studies. The studies were conducted by the Technical Developments Branch.

The Analytical and Standards Branch processed curie quantities of short-lived fission products (MTR irradiation) in Bldg. 506 to produce millicurie quantities for radiochemical studies conducted in Bldg. 815. Microcurie quantities of fission products (cyclotron bombardment) were also used.

An investigation was made of a report from the MTR that capsules containing irradiated La_2O_3 produced radiation levels inconsistent with the amount of La^{140} produced. It was found that 17S aluminum (containing 3-1/2 to 4-1/2% copper) had been used in the capsule construction instead of the specified 2S aluminum (containing 0.2% copper). The 13-hr Cu^{64} produced during the irradiation raised the radiation levels above those acceptable to ICC specifications for the type container being used for shipment. New capsules will be fabricated from 2S aluminum and forwarded to the MTR.

Preliminary arrangements were made to determine the availability of the LMR Pool-type Reactor and the General Electric Test Reactor at Vallecitos to perform short-time irradiations for NRDL.

Nucleonics Division

A 400-curie Co^{60} source, in a special shielded container, is being used at multiple positions and angles to simulate a passing cloud of fission products.

A series of slab-shielding experiments were conducted in the NRDL south grade range. The 40-curie Co^{60} source, with 4π geometry, used originally, was later replaced by the 400-curie Co^{60} source. By operating the source remotely and remaining behind barriers, personnel exposure, in general, was limited to less than 10 mr/hr. Exposure levels up to 100 mr/hr were experienced for very short times during the opening and closing of the source holder plug. The maximum dose rate observed at the fence bounding the area was 1.5 mr/hr. Later the source was oriented so as to beam over the water in a southeasterly direction. A monitoring survey was made on the opposite shore line in the dump area near Candi[illegible]k. Only background levels were observed. The radiation beam [illegible]ted with signs at the 10 mr/hr contour. Constant surveillance [illegible]e water area out to 2,000 ft will be maintained whenever the source is exposed. The security of the area was tightened to ensure complete compliance with requirements set forth in 10 CFR 20.

A series of ship-shielding experiments were conducted on the deck of the USS COWPENS using the 2000-curie Co^{60} "snake-source". The maximum radiation intensity, as measured on the pier adjacent to the ship, was about 300 mr/hr. Maximum exposure levels observed in the vicinity of personnel were about 10 mr/hr. Personnel are not permitted on the pier when the source is exposed for experimentation.

Preliminary work has been accomplished relative to the procurement of a Kg Pu-F_4 neutron source. On receipt of the necessary information, the Laboratory will request, from the Atomic Energy Commission, a modification of the Pu possession limit of NRDL license SNM-35.

Special monitoring surveys were made to delineate the neutron beams produced by the NRDL Van de Graaff accelerator while generating a deuteron beam. The target is located about 50 ft from the axis of the accelerator tank. When the deuteron beam was bent 90 deg from the vertical, a neutron flux was generated around the magnet. At a machine potential of 0.9 Mev, a flux of 1200 $n/cm^2/sec$ (150 mrem/hr) was observed. The operator was advised to make any adjustments at 0.6 Mev and then evacuate the area before raising the potential. The neutron flux at 0.6 Mev was less than 25 $n/cm^2/sec$ (3 mrem/hr). With the low beam currents used during experimental measurements, no neutron fluxes were detectable in the vicinity of the target.

A 200-curie Co^{60} source is now in use in the fourth floor instrument calibration range (Room 4121). The radiation levels around Room 4121 were measured with the 200-curie Co^{60} and the 120-curie Cs^{131} sources both open. The maximum level observed outside the direct cone of the beam was 15 mr/hr with a 0.1 mr/hr minimum and 4 mr/hr average. The radiation levels outside Room 480 were measured with the 25-curie Co^{60} source open. The maximum level observed outside the beam cone was 0.75 mr/hr with 0.16 mr/hr minimum and 0.4 mr/hr average.

Delineation of the radiation beams of the 200-curie Co^{60} source and of the 120-curie Cs^{137} source with permanent floor marking and a 3-ft chain barrier is planned for the purpose of providing more positive dosage control in the instrument calibration range (Rm. 4121). Operating conditions will be indicated by flashing red and white lights interlocked to each source control.

The Radiological Physics Branch was given assistance in the preparation of beta plaques for film dosimetry studies.

Installation of a 10-curie Co^{60} source in the "climatic simulator" is being planned. Local shielding will be used to reduce the radiation levels in the rear of Bldg. 815 to less than 2 mr/hr.

Biological and Medical Sciences Division

The radiation leak in the Westinghouse 250 KV X-ray control panel in Room 591 has been repaired, even though it was determined that no significant radiation hazard existed. Additional lead shielding was placed around the power cable ports. It was determined that the radiation leak was due to the failure of the Westinghouse repairman to replace a lead collar when the X-ray machine was last repaired. It was recommended that a thorough check be made of the shielding integrity following alterations and prior to the official acceptance of the repair.

An inspection was made of the 1 MEV X-ray installation in Bldg. 510A in order to determine that all rad-safe controls were still in effect. No discrepancies were noted. The safety line to the right of the control panel was repainted and new "Radiation Source" signs were posted. The environmental monitoring film on the rear cyclone fence was processed after a continuous 1-yr exposure. The accumulated dose on the film was 200 mr, which would average out to 0.6 mr/day. The machine had been operated in March 1959 for 82 hr over 13 separate days for animal irradiation experiments by the Bio-Physics Branch. No significant personnel exposures were noted.

The program of the Bio-Chemistry Branch involving the use of tritium, K^{42} and Br^{82}, in humans was continued during the first quarter. The detecting equipment has been refined to the extent that much smaller quantities of radioisotopes are used (i.e., 15 μc of K^{42} instead of 50 μc). Later in the year an application for the renewal of the NRDL human use license for K^{42}, Br^{82}, and H^3 was forwarded to the AEC via BuShips and BuMed.

A monitoring survey of Room 5149 after the use of a thorotrast compound in animals indicated no detectable contamination. Investigation of an ultrasonorator apparatus for disolving trace quantities of uranium, located in Room 5125, revealed no indication of space contamination.

Faulty operating procedures involving the use of one of the portable X-ray units resulted in a radiation exposure almost in excess of the monthly maximum permissible exposure (MPE). A new operating procedure for all X-ray units has been issued and posted to prevent future instances of this nature.

Routine rad-safe support was provided during the continuation of experiments involving millicurie quantities of HTO, I^{131}, Fe^{59}, P^{32}, Na^{22}, Sr^{89}, and K^{42}.

The increased use of finger badges was recommended in order to determine whether any significant hand exposures result from the present routine handling procedures of isotope solutions. To date, no significant exposures have been detected.

Technical Services Department

During the monitoring survey of the NRDL barge (YFN-16), contamination of tanks, piping, floor spots, and a spray booth was found to be at a nominal level of 5 mr/hr (O.W.). Surface decontamination methods and removal of the piping reduced the contamination and a final clearance of the barge was established.

Twenty-five special work permits were issued during the year. This work included packaging of waste materials, hood decontamination, contaminated equipment repair, and the general clean-up of specific areas and buildings. The amount of contamination involved in the work was minor and no significant rad-safe problems were encountered.

In view of past difficulties resulting from handling acid liquid wastes containing radioactivity, a new pick-up procedure was established. Personnel responsible for waste pick-up have been provided with kits containing a solution of thymol blue (a pH indicator which gives a positive color reaction) and a quantity of sodium hydroxide. The use of the kits has been very satisfactory and excess acidity in several collection jugs, detected at time of pick-up, was neutralized on the spot.

A steam cleaning unit with detergent pick-up was procured for use in the decontamination facility in Bldg. 364. Use of this unit in the decontamination of rat cages and source containers has proved almost 100% effective.

Monitoring support was supplied for the packaging and marking of 200 drums and 10 blocks of NRDL radioactive waste. In addition, support was supplied for the monitoring and labeling of 300 drums of UCRL waste.

Routine rad-safe support was given to the day-to-day service operations of the Technical Services Department.

Accidents

Two minor radiological accidents occurred during the year.

On 20 October 1959, a small amount of contamination (500 cpm) found on the shoes of a maintenance man led to the disclosure that contaminated rat livers (20 mrad/hr at 1") had inadvertently been placed in a waste basket in Room 525. No detectable contamination was found in the corridors of the fifth floor. The incident was due to failure to follow established procedures for the disposal of contaminated animal waste. The initial shoe contamination was disclosed in a routine hand and shoe check at the end of the work day.

In late October 1959, during the monthly processing of NRDL film badges, a high beta exposure (3.5 rad) was discovered on the badge of one individual in Bio-Med. A check of the work environment disclosed uncontrolled Sr^{85} contamination in Room 549 (10-30,000 cpm) and on the work clothes (1-3,000 cpm) of the person involved. A urinalysis for Sr and gross beta was negative. All contamination was removed or stabilized for future removal.

Spills

Five minor spills occurred durin[illegible] year.

Shoe contamination resulted from a minor spill of Rb^{86} in Room 622 on 6 February 1960. All contamination was successfully removed.

In the first quarter a spill occurred during the filling of a liquid waste drum. Internal corrosion of the drum developed a hole through which about 35 gal of liquid escaped to the asphalt. An area of about 75 sq. yd. was contaminated up to levels of 20 mr/hr (O.W.). No alpha contamination was detectable. A radio assay of the contents of the drum indicated a specific activity of 7×10^{-3} $\mu c/cc$. The area was decontaminated by removing a surface layer of asphalt (to a depth of 4 in. in spots). The maximum radiation level in the hole was 1 mr/hr (O.W.). This was reduced to less than 0.2 mr/hr (O.W.) when the depression was filled with a layer of concrete.

In Room 682 on 20 August 1959, a solution containing 20,000 cpm of Sr^{89} was spilled. The investigator's shirt was contaminated to the order of 300 cpm. After the shirt was washed in the NRDL decontamination laundry, it was released to the owner.

A small spill occurred during the third quarter of the year in the waste disposal area (Room 707) when a liquid-filled drum developed a leak. The waste was low level and no detectable surface contamination resulted. Acid wastes which had not been neutralized prior to pick-up had brought about the drum leak. A revised pick-up procedure for the Laboratory should prevent the recurrence of similar incidents.

Several persons sustained minor face and hand contamination as a result of decontaminating the hood in Room 1109, in spite of the fact that they were completely outfitted in protective clothing. Skin decontamination measures proved effective and results of urinalyses indicated an absence of internal contamination. (The contaminant involved was Tl^{204}.)

On 22 November 1959, a minor spill involving Ba^{140} and Cs^{137} occurred in Room 667. Floor contamination (50,000 cpm) and clothing contamination (20,000 cpm) were minor. No skin contamination was observed. All contamination was successfully removed.

Project 1.20 Dosimetry

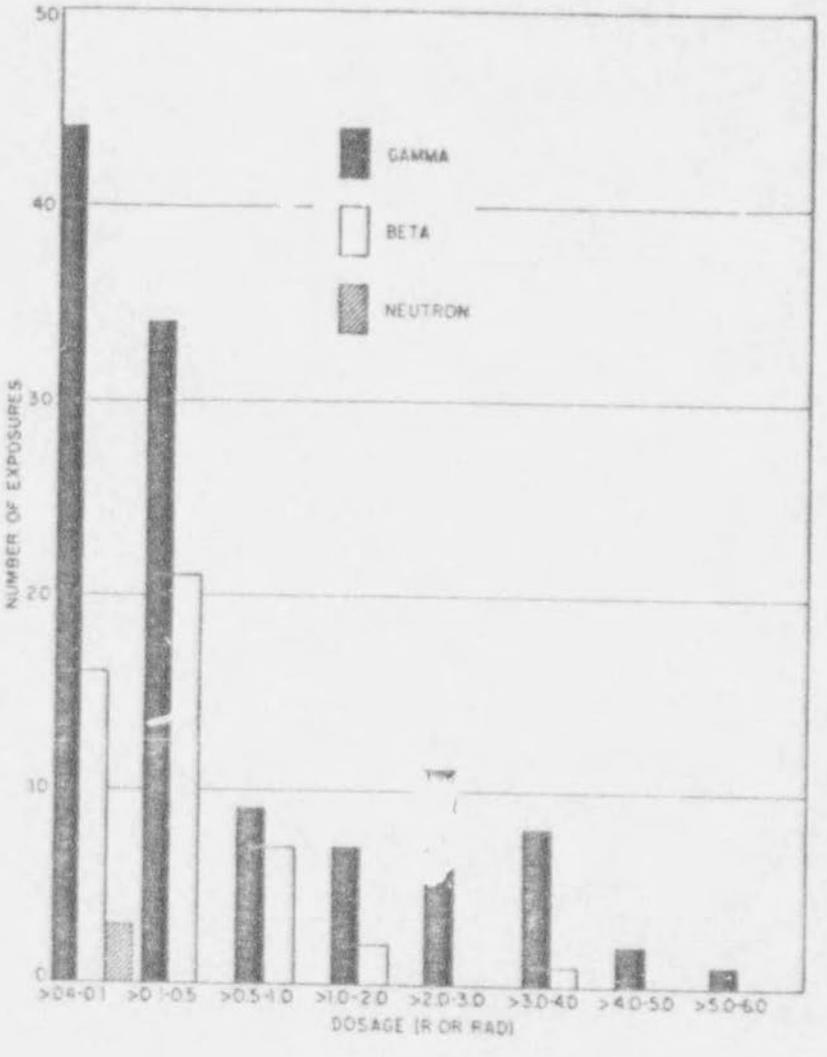
Film was processed for NRDL and outside activities as follows:

NRDL	Film Processed
Laboratory personnel	7,56
Laboratory visitors	1,4
Environmental monitoring	[illegible]
Calibration film	2
Special (wrist badges, etc.)	6
HYDRA I	
NRDL personnel	15
DDMB personnel	17
Camp Parks	
NRDL personnel and visitors	385
Environmental monitoring	56
Calibration film	5
Special film for Chem-Tech	33
Other	7
RADCON Team	5
SUBTOTAL	10,189
OUTSIDE ACTIVITIES	
San Francisco Naval Shipyard	1,046
Treasure Island	
Radiac Maintenance School and Dispensary	2,939
INSMAT	494
Port Chicago	221
NAS Moffett Field	51
MSTS, San Francisco	17
Marine Corps Fwd Supply Annex	11
NSC Oakland	63
USN Dispensary, 50 Fell St., S.F.	31
DPWO, 12 ND	12
NAS Fallon	6
McClellan Air Force Base	42
SUBTOTAL	3,887
GRAND TOTAL	14,076

Twenty-one exposures in excess of the MPE were detected during the year by the film badge program for NRDL personnel and visitors. A Chem-Tech investigator received 1.42 rem of gamma and neutron radiation while working at the University of California 60-in. cyclotron. The compensation for this technical overexposure of 0.12 rem was a 3-day period without exposure to ionizing radiation. The investigator was cautioned to avoid unnecessary exposure. A report of this case was made to BuMed in accordance with established directives. Twenty exposures were associated with the experimental program conducted at Camp Parks. The exposures varied from 1.5 to 4.0 r. The average exposure was 2.6 r. In only one case was the total for the year more than 5.0 r (5.25r). The details of these incidents have been reported to the AEC and BuMed in accordance with established directives.

In addition to the film supplied by NRDL, some film badge monitoring was done by a commercial film monitoring service on a contract basis. The service provided was for neutron dosimetry and finger rings for beta-gamma exposure. Neutron badges numbering 131 were exposed during the year. The maximum monthly dose indicated was 10 mrem. Evaluation of 51 finger badge exposures was made. The maximum exposure for a five-week period was 6.4r. (The hand MPE for this time interval is 7.5r.)

The accompanying bar graph presents the distribution of radiation exposures as indicated by film dosimeters for the 499 employees on board at the end of the calendar year 1959. Personnel terminating prior to the end of the calendar year 1959 are not included in the total. The average annual exposure per person was: X ray and gamma, 200 mr; beta, 35 mrad; and neutron, 1 mrem. The maximum X ray and gamma exposure was 5.3 r experienced during the engineering scale reclamation studies conducted at Camp Parks. The maximum beta exposure of 3.5 rad occurred in the Biological and Medical Sciences Division, apparently from contamination on the personal clothing of one investigator.



Distribution of Film Badge Totals, NRDL 1959

Bio-Assay Program

The following table summarizes the bio-assay results received from the Radiological Health Division during the year.

Division	Number of Samples		Results
	Gross Analysis	Specific Isotope	
Bio-Med	38	1 - Fe^{59}	NSA*
Chem-Tech	9**		NSA
	30		NSA
		2 - Sr^{89}	NSA
		21 - Ba^{140}	NSA to $2.4 \times 10^{-3} \mu c/l$
		36 - H^{3}	NSA
		36 - La^{140}	NSA
Engineering	2**		NSA
	14		NSA
		10 - La^{140}	NSA
		1 - Ba^{140}	$4 \times 10^{-5} \mu c/l$
Nucleonics	30		NSA
MED	7		NSA
		1 - Ba^{140}	NSA
Health Physics	6		NSA
	1**		NSA
		3 - Tl^{204}	NSA
		3 - La^{140}	NSA
		2 - U	NSA
		12 - H^{3}	NSA
Radiological Health		1 - Ba^{140}	$9 \times 10^{-4} \mu c/l$
		1 - Ba^{140}	NSA
Tech-Info	4		NSA
Project Officers	5		NSA
Administrative Dept.	8		NSA
Civilian Personnel	1		NSA
Security	1		NSA
NOTS		1 - U	NSA
DTMB		19 - La^{140}	NSA
NAD Concord		1 - Ra^{226}	NSA
SFNS		46 - Pu^{239}	NSA

* No significant activity
** Pre-operational urine samples for HYDRA I

During the second quarter of 1959, the Bio-Assay program was placed under the direction of the Medical Department. This action was the result of recommendations made by a committee composed of personnel from Health Physics, Radiological Health, and Analytical Standards.

Project 1.30 Radiological Services for Laboratory Operations

Accountability

The following table summarizes the radioisotope orders processed and shipments received for each division during the year.

Division	Orders Processed	Shipments Received
Bio-Med	43 orders - 501 mc	113 shipments - 574 mc
Chem-Tech	27 orders - 1181 mc	52 shipments - 506 mc
Nucleonics	20 orders - 2009 mc	18 shipments - 2511 mc
Health Physics	3 orders - 1150 mc	6 shipments - 1125 mc
TOTALS	93 orders - 4841 mc	189 shipments - 4716 mc

Multicurie sources were received as follows:

Division	Radioisotope	Quantities
Chem-Tech	Pu^{239} - Al foil	0.62 g Pu
	H^3	5 c, 20 c
	Ba^{140} - La^{140}	130 curies
Nucleonics	H^3 - Zr target	1 c
	Co^{60}	100 c, 206 c
	Pu-Be	80 g Pu

Thirty-five cyclotron and reactor-irradiated samples were processed and received during the year. An undetermined quantity of activity was produced in these irradiations.

On the average, about 103 items totaling 1.90 curies of radioactivity were in use by the Laboratory throughout the year, and seventeen items totaling 107 mc were stored in Room 1109.

The following table summarizes the radioactive sources currently available in the Laboratory:

Isotope	Number	Total Quantity
Co^{60}	49	1770 curies (0.7 mc to 809 c)
Cs^{137}	6	450 curies (1 mc to 200 c)
Ra	11	1119 mg (0.1 to 500 mg)
Ir^{192}	1	1.9 curies
Sr^{90}	46	3.3 curies (1 mc to 2c)
Ra-Be	5	138 mg Ra (2 to 100 mg)
Pu-Be	3	162 g Pu (2 to 80 g)
H^3-Zr	4	6 curies (150 mc to 2.6 c)

Three point sources were prepared for the Nuclear Radiation Branch, as follows:

Au^{198}	2 curies
W^{185}	40 mc
Ce^{141}	58 mc

The NRDL Byproduct Material License has been renewed with an expiration date of 31 March 1961.

As requested, the AEC has included in the license a condition that permits byproduct material to be used at any Navy, Army, or Air Force facility provided such use is under the direct supervision and control of Laboratory personnel in accordance with procedures established by the NRDL Radioisotope Committee. This will greatly simplify the problem of Laboratory personnel using byproduct material outside the immediate confines of Bldg. 815.

On 25 May 1959 NRDL was issued Byproduct Material License No. 4-489-6 authorizing the disposal of radioactive waste at sea; the license will expire 30 April 1961. New stipulations concerning packaging, labeling, and disposal sites were noted. In addition, a 20-day advance notice to the AEC of NRDL's intent to dispose of waste in the ocean is now required as well as a manifest of the load type and quantity.

The AEC amended NRDL's Byproduct Material License No. 4-487-3, effective 3 September 1959, as follows:

H^3	100 curies
Any byproduct material with atomic Nos. 3-84 inclusive	5 curies each except:

Co^{60}	-5000 curies	Ir^{192}	-5000 curies
Cs^{137}	- 750 curies	Ba^{140}	-1000 curies
Hg^{203}	- 10 curies	La^{140}	-1000 curies
Sr^{90}	- 100 curies	Mixed FP	-100 curies

Byproduct Material License No. 4-487-7, effective 21 September 1959, which authorized the use of H^3, K^{42}, and Br^{82} in human volunteers, was received. The following possession limits are authorized:

H^3	50 mc
$K^{42}Cl_{82}$	3 mc
NH_4Sr	9 mc

The license expires on 30 September 1961.

A letter was forwarded to the AEC by NRDL on 10 September 1959 requesting a modification to the Pu possession limit by NRDL license No. SNM-35.

NRDL Radioisotope Catalogue No. 7 was completed and distributed to all interested personnel.

Waste Disposal

Fourteen barge loads of radioactive waste were discharged at sea during 1959. Load types and quantities were as follows:

Date	Source	Total Curies	Type and Quantity
13 Feb 1959	UCRL (Berkeley)	2.42	242 drums (88 tons)
	Dugway Proving Ground	1.1	42 drums (18 tons)
19 Feb 1959	UCRL (Berkeley)	1.5	3 blocks (31 tons)
		1.0	105 drums (36 tons)
	McClellan AFB	0.0003	42 drums (19 tons)
	Dugway Proving Ground	0.8	27 drums (12.5 tons)
26 Feb 1959	McClellan AFB	0.0006	34 drums (14.5 tons)
		0.0002	2 blocks (14 tons)
	NSC Oakland	0.015	18 drums (9 tons)
	SFNS	1.0	61 drums (17 tons)
		0.2	1 block (8 tons)
	UCRL (Berkeley)	4.5	158 drums (56 tons)
2 April 1959	UCRL (Berkeley)	1.50	3 blocks (30 tons)
		1.0	114 drums (40 tons)
	McClellan AFB	0.0990	54 drums (15 tons)
		0.0002	1 block (6 tons)
	NRDL	0.0001	12 drums (3.4 tons)
14 April 1959	UCRL (Livermore)	0.0034	170 drums (64 tons)
	UCRL (Berkeley)	0.0015	74 drums (28 tons)
	SFNS	0.160	16 drums (4.5 tons)
	NRDL	0.020	80 drums (32 tons)
24 April 1959	UCRL (Livermore)	0.300	96 drums (37 tons)
	NRDL	0.051	204 drums (61 tons)
30 April 1959	UCRL (Livermore)	0.40	152 drums (57 tons)
		40.0	4 blocks (44 tons)
	NRDL	0.007	28 drums (8 tons)
1 June 1959	UCRL (Livermore)	0.0040	180 drums (63 tons)
		40.0	4 blocks (32 tons)
3 June 1959	UCRL (Berkeley)	0.960	96 drums (36 tons)
	NAS Alameda	0.0001	3 drums (2 tons)
		0.0004	14 blocks (350 tons)
			Piping (0.1 ton)
	McClellan AFB	0.0950	6 drums (3 tons)
		0.0003	2 blocks (10 tons)
	UCRL (Livermore)	0.0020	58 drums (24 tons)
23 June 1959	UCRL (Livermore)	0.0030	96 drums (36 tons)
		40.0	4 blocks (44 tons)
	UCRL (Berkeley)	0.960	96 drums (36 tons)
13 Oct 1959	UCRL (Livermore)	0.004	156 drums (42 tons)
	NRDL	0.075	132 drums (50 tons)
		0.010	4 blocks (40 tons)
2 Nov 1959	UCRL (Livermore)	0.676	305 drums (95 tons)
	McClellan AFB	0.010	1 block (8 tons)
6 Nov 1959	UCRL (Livermore)	0.226	45 drums (17 tons)
	UCRL (Berkeley)	0.240	243 drums (89 tons)
	NAS Alameda	0.001	2 blocks (8 tons)
	NRDL	0.080	4 blocks (32 tons)
12 Nov 1959	UCRL (Berkeley)	0.160	160 drums (65 tons)
	NRDL	0.005	40 drums (17 tons)
		0.010	2 blocks (27 tons)

The total amount of radioactivity discharged during the year was 139.6 curies, distributed through 1879 tons of material, as follows:

Container	Total Curies
3345 drums (1195 tons)	16.288
51 blocks (684 tons)	123.312
3396 containers (1879 tons)	139.600

The USS CAHOKIA reported 8 floating drums, as follows:

13 Feb. 1959 - 1 drum
19 Feb. 1959 - 2 drums
26 Feb. 1959 - 1 drum
14 Apr. 1959 - 2 drums
1 June 1959 - 1 drum
6 Nov. 1959 - 1 drum

All drums were sunk by rifle fire.

Personnel of NRDL and the USS CAHOKIA continued discussions regarding the radiological safety measures for crew members aboard the YGN-73 during waste disposal trips to sea. Laboratory personnel made recommendations to the Commanding Officer of the CAHOKIA as to the degree of dress-out required for the several possible conditions of barge contamination. Interaction also continued between NRDL and SFNS personnel relative to the rad-safe aspects of loading the barge. They established a procedure requiring that a SFNS monitor conduct a survey of each loaded barge, documenting the results on a monitoring form provided to the CAHOKIA each time the barge is towed to sea.

At one time during the third quarter the YGN-73 was found to be contaminated in certain areas with Pu^{239} (maximum level - 100,000 d/m per 60 cm^2). During repair and overhaul by SFNS, the barge was decontaminated to less than 500 d/m per 60 cm^2.

The USS CAHOKIA was not available for waste disposal trips to sea until the fall of the year. The AEC Division of Licensing and Regulations was given the required advance notice of the scheduled dumping dates.

The Chief of Naval Operations has directed the Commander of MSTS to assume responsibility, within the Department of the Navy, for disposal of radioactive waste material at sea; this order was effective on 1 July 1959. Therefore, those activities which were disposing of radioactive wastes under the license of NRDL have been advised that this Laboratory will not accept radioactive wastes after 29 June 1959.

After negotiating with commercial waste disposal service companies regarding the disposal of NRDL radioactive waste material, it was finally decided not to establish a standard contract because of the small amount of radioactive waste currently generated by this Laboratory. Instead, individual purchase orders will be written at the time a sufficient quantity of waste has accumulated.

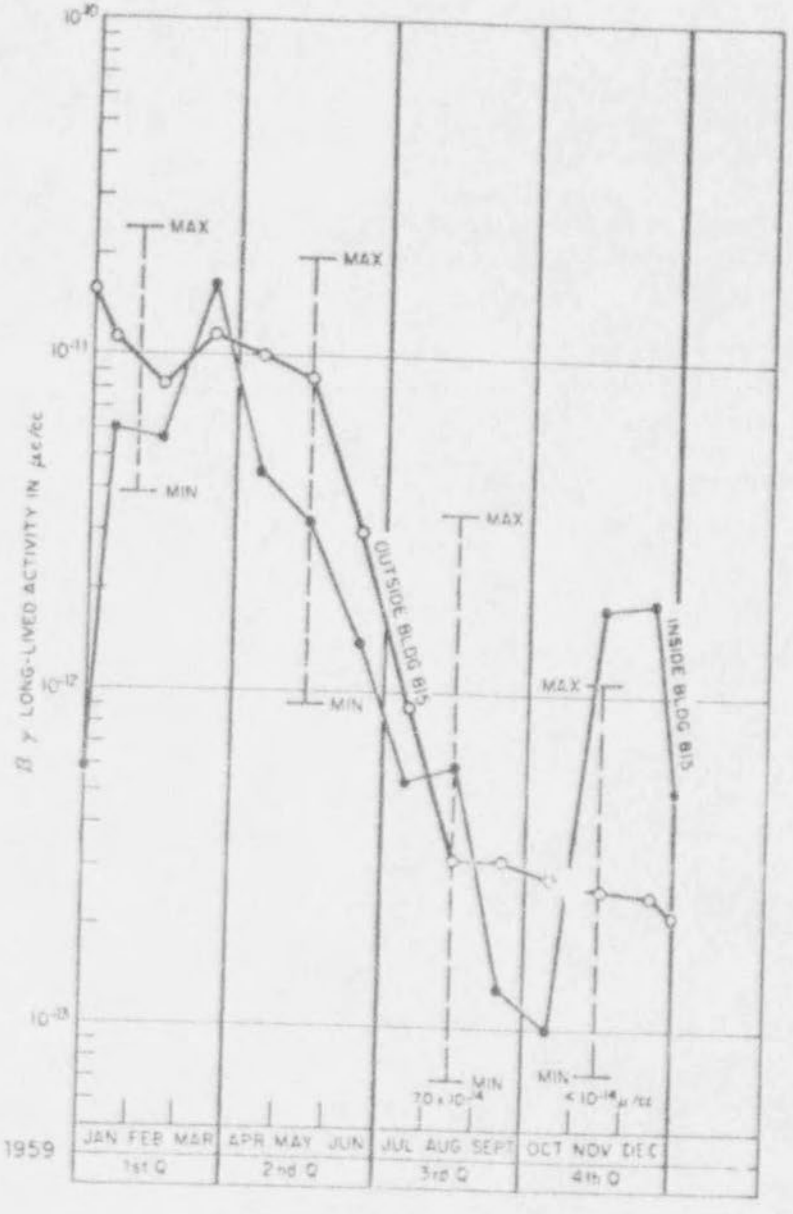
Decontamination Laundry and Protective Equipment Issue

Contaminated Laboratory Coats

Quarter	Contamination Level (cpm)		No. by Division		
	Min.	Max.	Bio-Med	Chem Tech	Other
1st	1,000	12,000	-	7	1 Unknown 2 HealthPhysics
2nd	1,000	50,000	4	3	--
3rd	1,000	3,000	4	-	--
4th	1,000	20,000	6	1	--

Project 1.40 Environmental Survey

The graph on page 23 gives quarterly averages of the air sampling of outside air and bldg. 815 air effluent. Environmental aerosol sampling of inside and outside air indicated a significant decrease of long-lived radioactivity since cessation of weapons tests in the fall of 1958. These data are consistent with those reported by other activities. The general level of long-lived activities observed during the last half of 1959 was one order of magnitude less than in 1958. At no time were levels recorded in either system which indicated release of greater-than MPC levels of particulate radioactivity in the environmental air.



USNRDL Environmental Aerosol Data for 1959

The sixth floor air exhaust sampling system, located on the roof of Bldg. 815 was discontinued on 31 October 1959. After this date, Bldg. 815 hood and air effluent was continuously monitored by the new instrumentation setup in Room 618. Each 24-hour air sample is automatically counted at the conclusion of the sampling period. A record is made of the decay and total activity. It is believed that with the improved sample collection and counting equipment now available, better information will be obtained on the concentration of radioactivity resulting from Laboratory operations that are released to the environment. It is planned to test the sensitivity of the sampling equipment early in 1960. Tracer quantities of Au^{198} released in several Laboratory hoods by a fog generator will be used.

Air and Water

Effluent Monitoring System

The construction of a liquid effluent collection and monitoring system in the area adjacent to the west side of Bldg. 815 was completed in 1959. This work included the excavation for and placing of two 15,000-gal. tanks designed to hold all nonsanitary Laboratory waste.

The air monitoring system was assembled, installed, tested and placed in working order during the year. Despite difficulties encountered and overcome on the sample collector and paper movement system, the over-all operation of the system indicates that it is an improvement over previous equipment of this type.

The following liquid and soil samples were collected and counted for gross beta-gamma activity.

Location	Type of Sample	Date Sampled	Concentration μc/cc or μc/g	Disposition
Rain gauge on roof	Rain water	5 Jan 1959	8×10^{-7}	
"	Rain water	9 Jan 1959	1.8×10^{-6}	
"	Rain water	14 Jan 1959	1.5×10^{-6}	
Barge tank No. 1	Liquid waste	2 Mar 1959	5×10^{-5}	Into Bay
Gun mole tank No. 1	Liquid waste	2 Mar 1959	1.4×10^{-5}	Into Bay
Gun mole tank No. 2	Liquid waste	2 Mar 1959	1.2×10^{-5}	Into Bay
GITR tank (Bldg 364)	Liquid waste	10 Mar 1959	2.2×10^{-6}	Held in tank
Polyvinyl catch pool (GITR tank)	Rain water	10 Mar 1959	2.5×10^{-5}	Held in pool
Barge tank No. 2	Liquid waste	10 Mar 1959	8.4×10^{-4}	Barreled
Rear, Bldg. 369	Soil	13 Mar 1959	1.4×10^{-6}	--
Tanks at NW corner, Bldg. 815	Liquid waste	16 Mar 1959	3.1×10^{-3}	Barreled

Location	Type of Sample	Date Sampled	Concentration μc/cc or μc/g	Disposition
Pump (Bldg 364)	Water in pump	18 Mar 1959	4.8×10^{-3}	Indicates pump contamination
Spray Booth (Rm 184B)	Liquid waste	19 Mar 1959	9.3×10^{-5}	Into sewer
Bldg. 364	Pump Water	17 May 1959	4.0×10^{-3}	Barreled
	Rain Water	17 May 1959	3.9×10^{-6}	Into sewer
Barge	Storage tank	31 June 1959	NSA	Into sewer
	Drainage from barge	31 June 1959	NSA	Into sewer

No sample analysis for the disposition of tanked or barreled liquid waste was required during the third quarter. One liquid sample was analyzed for SFNS. No detectable α or β activity was found and the tank contents were discharged into the Bay. As additional information on general background, a tap water sample was assayed and found to contain 7.4×10^{-9} μc/cc.

The liquid effluent collection system was completed and placed into operation late in the year. A routine sample analysis was begun on 7 December 1959. A 1-liter sample is processed for each 15,000-gal hold-up tank prior to release into the sanitary sewer system. Gross β-γ and α counts are made on each sample. NBS-69 recommends an MPC of 2×10^{-5} μc/cc for an occupational exposure of 168 hr/wk if the isotopes SR^{90}, I^{129}, Pb^{210}, Ra^{223}, Ra^{226}, Ra^{228}, Pa^{231} and Th-natural are not present. Since none of these isotopes is currently in use at NRDL as an unconfined source, an MPC of 1×10^{-6} μc/cc (10% of the Industrial MPC) for uncontrolled release into the sewer system has been established. A 100-cc aliquot from each 1-liter sample is accumulated for one month, at which time a detailed radiochemical analysis is made to confirm, for the record, that the above isotopes are not present.

A new liquid-sample processing system is being designed that will permit a number of samples to be evaporated at the same time. This should be in operation in 1960 and will significantly reduce the sample processing time.

Radiation Intensity Monitoring

The uncontrolled spaces in Bldg. 815 that were monitored and the average accumulated dose per 24 hours, by quarters, were as follows:

Location	Average Daily Dose (mr/day)			
	1st Q	2nd Q	3rd Q	4th Q
Room 5193	1	10	2	2
Room 480				
N wall	30	20	1	4
S wall	10	6	2	9
E wall	--	--	2	4
Room 448	1	--	2	1
Room 448 Outside wall passage-way	--	--	--	1
Room 595	40	3	2	--
665	12	3	6	13
666	1	--	1	6
579	3	10	5	--
682	--	--	1	6
687	--	--	1	6
597	--	--	1	6
Room 597 Outside wall passage	--	--	1	7
Room 597 passageway	--	--	--	1
Room 591	--	--	2	2
Room 5149				
N wall	--		1	1
E wall	--	--	1	1
S wall	--	--	1	1
W wall	--	--	1	1
Room 2117				
S wall	--	--	8	--
E wall	--	--	3	17
Room 2181				
S wall	--	--	6	6
Room 2129	--	--	1	5
Room 110				
S wall	--	--	1	2
W wall	--	--	--	2
N wall	--	--	9	6
E wall	--	--	2	2
Room 2177				
S wall	--	--	--	9
Room 165				
N "A" frame	--	--	--	6
S "A" frame	--	--	--	7
E wall	--	--	--	5
W wall	--	--	--	5

The controlled spaces in Bldg. 815 that were monitored and the average accumulated dose per 24 hours, by quarters, were as follows:

Location	Average Daily Dose (mr/day)			
	1st Q	2nd Q	3rd Q	4th Q
Room 4121				
N wall	1	5	10	12
E wall	6	20	30	10
S wall	6	20	40	9
W wall	1	5	10	6
Room 1109				
N wall	10	25	140	80
E wall	40	20	60	57
S wall	50	--	135	130
W wall	30	--	40	40
Room 110				
W wall	--	--	50	--
Room 480				
W wall	--	--	50	100
Room 2125				
N wall	--	--	1	8
E wall	--	--	6	8
S wall	--	--	1	8
W wall	--	--	1	10
Room 187				
Near operator's bench	--	--	1	--
Operator's bench	--	--	--	2
Room 4128				
N wall	--	--	--	18
E wall	--	--	--	60
S wall	--	--	--	17
W wall	--	--	--	23
Bldg. 816				
Entrance to Target Room	--	--	--	100

Project 1.50 Rad-Safe Instrumentation

After the Jordan 5-channel remote area monitoring system was finally made to conform to the original Laboratory specifications by the contractor, it was accepted by NRDL, and installed in Bldg. 510A. Consideration is still being given to the use of this system to support the shielding program.

A 5-inch zinc-sulphide scintillation counter for the measurement of alpha radiation from air samples collected by the Staplex Air Sampler was designed, fabricated, and is being tested by NRDL; this unit will augment the 3-inch counter now in use. Effort is being made to correct trouble experienced in reproducing counts obtained from standard samples.

A prototype water line monitor was designed and built to continuously monitor one of the main sewer drains from Bldg. 815. This monitor will be tested and installed on the main inlet line to the liquid effluent collection system. The monitor consists of a 1-1/2 inch (diameter) by 3/4 inch (thick) gamma counting crystal (NaI) in a probe that is connected to a rate meter and recorder.

A single-channel gamma radiation monitor was built for use with the 200-curie traveling source ("snake source") used on the USS COMPENS.

Tritium monitoring equipment T-289 and T-329 were received on a one-year loan basis from BuWEPS. The T-289, being used for tritium air monitoring, has been set up in Room 624 where curie quantities of tritium gas are being handled. The T-289 was checked against a known sample of tritium gas and indicated a concentration that was within 20% of the known value. The T-329 is used for tritium urinalysis; it has been calibrated and set up for routine operation in Room 218.

Program 2.0 Rad-Safe Evaluation

This program is chiefly concerned with the evaluation of special radiological problems within the Laboratory and from outside activities. About 10% of the total available effort was devoted to these evaluations. This program is divided into two subgroups to facilitate program planning and reporting.

Project 2.1 Radiological Evaluation and Procedural Development

NTDC. In compliance with a request of the Naval Training Device Center (NTDC), Port Washington, New York, as to the requirements for training equipment capable of disseminating radioactive material to simulate a fallout situation, a synoptic outline of the proposed operating procedures for the training device was submitted by NRDL for review. The outline was accepted and a rough draft of the operating procedure manual was completed. Completed also were a tentative design for a depleted uranium shipping container and a working prototype of a modified AN/PDR-18A using the electronics from an Eberline GM counter (E-112B). In order to establish the extent of future work on the evaluation of the radiological trainer, a conference has been scheduled for early next year at NTDC.

Naval Supply Center (NSC), Oakland. The radium storage facility at NSC was monitored for general contamination and the procedures for handling radium-bearing luminous markers were reviewed. All of the procedures formerly recommended by the NRDL had been implemented except for repainting the storage area after it had been decontaminated in March 1957. Monitoring of the storage area indicated the presence of some low-level contamination. A portion of this contamination was found to be removable and was due to the oxidation of the paint. It was again recommended that the walls be decontaminated and repainted with two coats of paint.

An evaluation was made of contamination associated with the removal of radium markers from interior communications equipment handled by NSC. Recommended procedures to be followed during the removal of markers and decontamination of equipment were forwarded to NSC by NRDL.

The radon concentrations in NSC's Bldg. 312 were measured by NRDL personnel; recommendations on possible methods of reducing the concentration of 1×10^{-8} μc/cc will be made.

Recommendations on the rad-safe aspects of handling and decontaminating radium-contaminated equipment were presented to personnel of the Medical and Safety Departments of NSC.

At the request of the NSC Medical Director, a radiological monitoring survey was made of the NSC personnel office (south gate). A minor amount (300-6000 d/m per 60 cm^2) of radium contamination was detected on the laminating machine and on the bench area (1000 d/m per 60 cm^2) near the laminating machine. This contamination was released from four radio-lite strips (1/2 in. x 4 in.), each containing 10 μg of radium, that were laminated about five months earlier in an attempt to control the loose radio-lite material. It is estimated that about five drops (about 0.8 μg) were exuded on the machine; the bulk of this was immediately cleaned up. In order to establish that there was no internal contamination of personnel who were working with the laminating machine, a radiochemical analysis of urine and stool samples was made. As a result of the monitoring, an estimation of the amount spilled, clinical examination, and bio-assay of the urine and feces of the exposed personnel, it was concluded that there was no evidence of significant radium exposure in the personnel involved and that no injury to their health resulted.

Army Signal Depot, Sacramento. General health physics problems, including photodosimetry and instrument calibration, were discussed with personnel of the Signal Depot Nuclear Branch.

ng Beach Naval Shipyard (LBNS). Existing training films on monitoring and the use of military radiacs were reviewed with a representative of LBNS who has been designated as the technical coordinator for five new training films. Technical errors in existing films were pointed out and suggestions were made on possible content for the five new films on monitoring with military radiacs.

San Francisco Naval Shipyard (SFNS). SFNS INST 9300.1A, Chapter 3, "Radiological Hazards," was reviewed and comments were made on the proposed revision.

Technical assistance was provided during the decontamination of the waste disposal barge (YGN-73) and in the evaluation of air, liquid, and wipe samples collected during the decontamination operation.

USS HANCOCK (CVA-19). Instructions were given to three USS HANCOCK medical officers on the use of a Western Densitometer. Photodosimetry problems associated with the use of medical X rays and handling of radioactive materials were discussed.

U.S. Naval Dispensary, Treasure Island. NRDL assisted the Dispensary in the investigation of an X-ray dose received by a technician and in the preparation of the necessary correspondence reporting the incident.

Naval Air Station (NAS) Alameda. Consultations were held with the industrial hygienist in connection with waste packaging procedures and the proper handling and disposal of a large quantity of radium dial paint.

Le Secretare General, Chantiers Navals de la Pollice, Paris, France. Information on NRDL waste-handling procedures and details of the disposal barge (YGN-73) were compiled and forwarded to BuShips for sending to Le Secretare General, Chantiers Navals de la Pollice, Paris.

Naval Nuclear Ordnance Evaluation Unit (NNOEU), Albuquerque, N.M. The contamination data available from NOTS Project 173 tests were reviewed. The available data to date are too meager to allow any conclusions to be reached. It was recommended that all samples with a possibility of being contaminated be processed, and that the resulting data be examined before any conclusions are drawn.

BuDOCKS. OPNAV INST 04040.22A of 30 June 1955 was reviewed. Recommendations were made regarding items (pertinent to rad-safe) that should be added to the equipment taken to advance bases.

Naval Ordnance Facility (NOF), Navy 214, c/o FPO, New York. At the request of NOF, information on radiation effects and radiac instruments was forwarded to the facility.

National Industrial Conference Board (NIC), New York. Information concerning rad-safe training practices, equipment, and procedures was furnished to the Manager of the Industrial Atomic Energy Department of the NIC.

John I. Thompson & Co., Washington, D.C. Information concerning wipe testing procedures and evaluation was transmitted to John I. Thompson & Company. The information was to be used in connection with the preparation of an ordnance pamphlet (OP 2507) being written for the Bureau of Naval Weapons.

McClellan Air Force Base. Approximately 35 film exposed in an RC-111 aircraft were evaluated for the Sanitary and Industrial Hygiene Engineer at the 2793rd Air Force Hospital. All film indicated positive exposure to low energy radiation from the electronic tubes used in the aircraft's radar sets.

American Industrial Hygiene Association (AIHA). A presentation was made at the March meeting of the Northern California Section of the AIHA on the contents of TR-283, "Contamination Control Procedures for Special Weapons Accidents."

Principles of Radiation and Contamination Control (PORACC). Following the review and approval of the 1957 draft of the three volumes of PORACC by BuShips, BuPers and BuMed, reproducible copy was prepared by a contractor. The plates for Volume I were sent to BuShips on 17 August 1959 and the publication was issued by the Government Printing Office (GPO) late in the year. This volume, entitled "Rad-Safe for Everybody," is available from the Superintendent of Documents, GPO, Washington 25, D.C., at 60 cents per copy.

At the end of the year approximately 80% of the final copy for Volume II was complete. It was estimated that the photostats of this volume would be sent to BuShips for review early in 1960.

The plates for Volume III were forwarded to BuShips for printing on 28 October 1959.

NRDL INST 5100.10 Rad-Safe Regulations and Procedures. This instruction, entitled "Rad-Safe Precautions," was released by the Commanding Officer and Director of the Laboratory under date of 13 February 1959.

RADCON Program. The report, entitled "Contamination Control Procedures for Special Weapons Accidents," was completed and issued as NRDL-TR-283.

Photodosimetry Calibration. Calibration curves were obtained for Co^{60}, for both the old and the new emulsions of dosimetry film. A calibration curve for the film emulsion currently being used was prepared using a Ba^{140} - La^{140} source. Studies on the effect of overdevelopment and degree of film fading were made.

Project 2.2 Rad-Safe Training

Personnel of NRDL Technical Services Department were the recipients of a number of specialized radiological safety training programs during the year. These programs were effective in improving the individual's understanding of the Laboratory's rad-safe practices. In addition, the outlines for two radiological safety courses planned for presentation to designated personnel of the Technical Services Department during FY1960 have been prepared.

Two proposed rad-safe courses planned for future presentation to personnel of the Scientific Department have been approved by the Commanding Officer of NRDL.

A lecture on "Health Physics Considerations" was delivered to SFNS radiac coordinators as part of an orientation course on neutron radiacs.

An outline of the material to be presented as a part of the Medical Officers Training Course to be held at the Naval Schools Command, Treasure Island, was prepared.

Program 3.0 Special Operations

About 8% of the total Health Physics Division effort was expended on Program 3.0. The program is divided into four subgroups to facilitate program planning and reporting.

Project 3.30 Stoneman II Rad-Safe Support

The Stoneman II Rad-Safe report was prepared, reviewed by the Reports Review Board, and issued as TM-111.

Project 3.40 Rad-Safe Support for Naval Ordnance Testing Station (NOTS), Project 173

Rad-safe support was provided to NOTS for weapons vulnerability tests conducted in March, May and November 1959. No significant rad-safe problems were encountered, although minor contamination problems were observed. The reports of these tests were issued in April and June 1959 and January 1960, respectively.

Special samples were collected and an analysis and evaluation of them was made at NRDL in connection with the evaluation of the contamination potential of the operational suitability tests program conducted at NOTS. A rough draft of the report has been prepared by the Radiological Effects Branch of Chem-Tech Division and is ready for the review and approval of the Reports Review Board; following approval necessary action will be taken to forward the report and related information to NOTS.

Project 3.50 Rad-Safe Support for RADCON

Effort in this area was expended on (1) participation in the RADCON exercise held at Moffett Field on 3 March 1959; (2) checking out the counting equipment assigned to the RADCON team; and (3) preparation of a series of Pu standards for field use with monitoring instruments.

Project 3.60 Rad-Safe Support for Camp Parks

A radiological background survey of the Camp Parks area was started in the latter part of August 1959. Five air-sampling stations were established to operate continuously. Four of these are located on the test site periphery and one at the center of the site. Forty-two environmental air samples were collected and analyzed prior to the arrival of any radioactivity. The average activity (on the basis of counting a 24-hour collection sample, 6 hr after collection) is about 1×10^{-11} $\mu c/cc$. About 50 environmental samples were also taken. These samples include soil, sanitary sewer effluent, and vegetation samples. The samples were analyzed by the Analytical and Standards Branch, and the report indicates that the level of activity was so low that spectral analysis was not possible.

Following the arrival of radioactivity, 150 environmental air samples were taken on the Camp Parks periphery. The highest specific activity noted at any station was 9×10^{-11} μc/cc and the average concentration for these peripheral stations was 5×10^{-11} μc/cc. Five additional air-sampling stations were located around the perimeter of the target complex and operated continuously during the experiment. Nineteen air samples taken at these five stations showed a maximum concentration of 1.6×10^{-9} μc/cc and an average concentration of 1×10^{-10} μc/cc. Twenty-four spot air samples were taken during various phases of the experiment. All spot samples except two were below the 40-hr MPC of 4×10^{-8} μc/cc. The two samples that exceeded this MPC were for 10-min periods during the spraying of the radioactivity on to the sand. The specific activity of the two samples was 3.2×10^{-6} μc/cc and 7.2×10^{-7} μc/cc. (The MPC for a 10-min exposure is 9.6×10^{-6} μc/cc).

A change station and rad-safe issue area were set up in Bldg. 880. Storage space for the radioactive simulant has been established in Igloo D (a remote magazine storage area) with a solid waste disposal pit (for short-lived radioactivity) set up across the road. Core samples were taken down to 8 ft. No migration of activity into the soil was observed. The "Hot Cell" in Bldg. 131 has been checked for radiation leaks. None was found and the "Hot Cell" appears to operate satisfactorily. Air-sampling devices have been installed within the cell and at the operator's window.

A document entitled "Rad-Safe Criteria for NRDL Operations at Camp Parks" was issued by the Chairman of the Radioisotope Committee in August 1959. This publication, which represents a recap of NRDL, state, federal and other pertinent regulations, is to serve as an interim rad-safe guide until a more formal plan is issued.

Approximately 35 persons were involved in the test operations. The maximum whole-body deep dose received was 4.0 r with the average dose being about 2.8 r. Some internal contamination was detected. The maximum specific activity found in the urine was 2.4×10^{-3} μc/l for a 24-hr sample. This is considered well below the level that would indicate that a significant part of the MPBB for Ba^{140} - La^{140} (10 μc) was retained. Changes are being made in the equipment and experimental procedures prior to the next experiment to ensure that all exposures of personnel will be below 3 r per quarter.

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DATE ISSUED: 1 November 1960